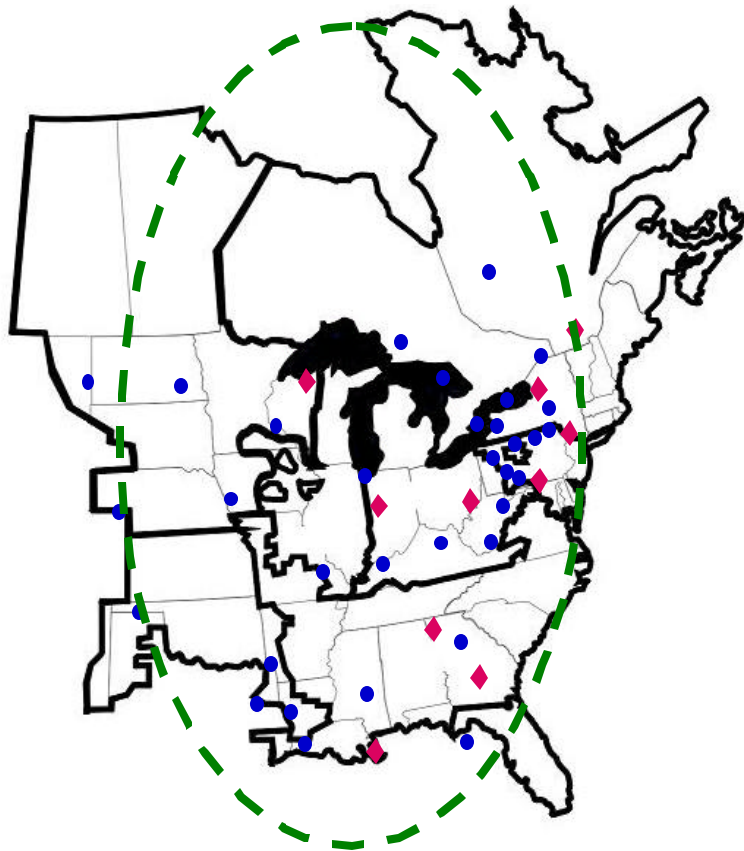


# *Eastern Interconnection Phasor Demonstration*

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**Enhanced Wide-Area Visibility  
In the Eastern Interconnection for  
Reliability Management**

**Transmission Reliability Program Peer  
Review  
Washington, D.C.**

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**Carl Imhoff**



**CERTS**  
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

# *Presentation Outline*

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1. Purpose of Eastern Interconnection Wide Area Measurement Demonstration
2. Review of Wide Area Measurement Systems (WAMS)
3. Benefits of Eastern Interconnection WAMS
4. Proposed Plan
5. Status Update



# *EI WAMs Demonstration*

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- **GOAL:** Facilitate evaluation and implementation of wide area, high-speed grid measurement in the Eastern Interconnection to enhance grid reliability management
  
- **BACKGROUND:**
  - DOE has been involved in tools and technology development in the Western system.
  - DOE discussions with EI ISOs and utilities in Fall 2002 resulted in expressions of interest for interconnection level monitoring to address emerging system behaviors
  - EIPP Demonstration initiated in FY03



# *Wide-Area Measurement System (WAMS)*

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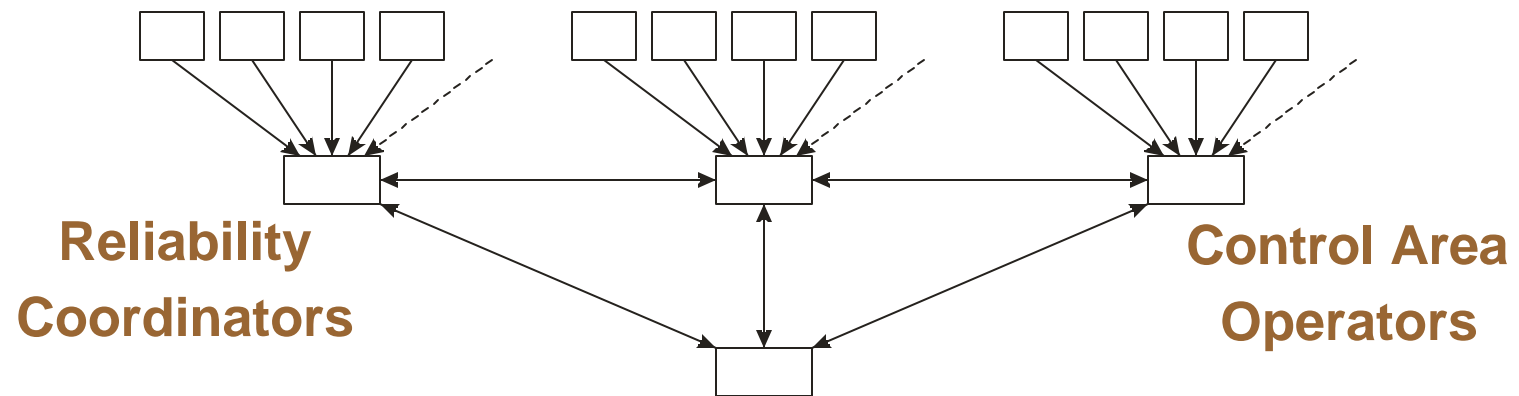
- Transmission lines and corridors are monitored on a wide-area basis
- Phasor Measurement Units (PMUs) and other measurement devices sample voltage (and current) waveforms
- Phasor Data Concentrators (PDCs) collect and compile PMU data
- Software applications analyze and present results
  - Real-time monitoring of phasor magnitudes and angles
  - Post-disturbance analysis
  - Validation of both steady-state and dynamic grid models
- Future applications enhance grid performance
  - Improved control against voltage collapse
  - Enhanced state estimation
  - Wide-area coordinated protection and control



# *Phasor Measurement Systems Structure*

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## **Critical Grid Locations**



# *Principal Benefits of EIPP WAMS*

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1. More comprehensive wide-area view of system
2. Rapid assessment of system conditions
3. Improved system models for steady-state and dynamic analysis
4. Enhanced post-disturbance analysis
  - *sequence of events*
  - *what happened first*
5. Power swing detection by on-line angle difference monitoring
6. Increased power system performance
7. Higher utilization of existing investments
8. Reduced outage costs



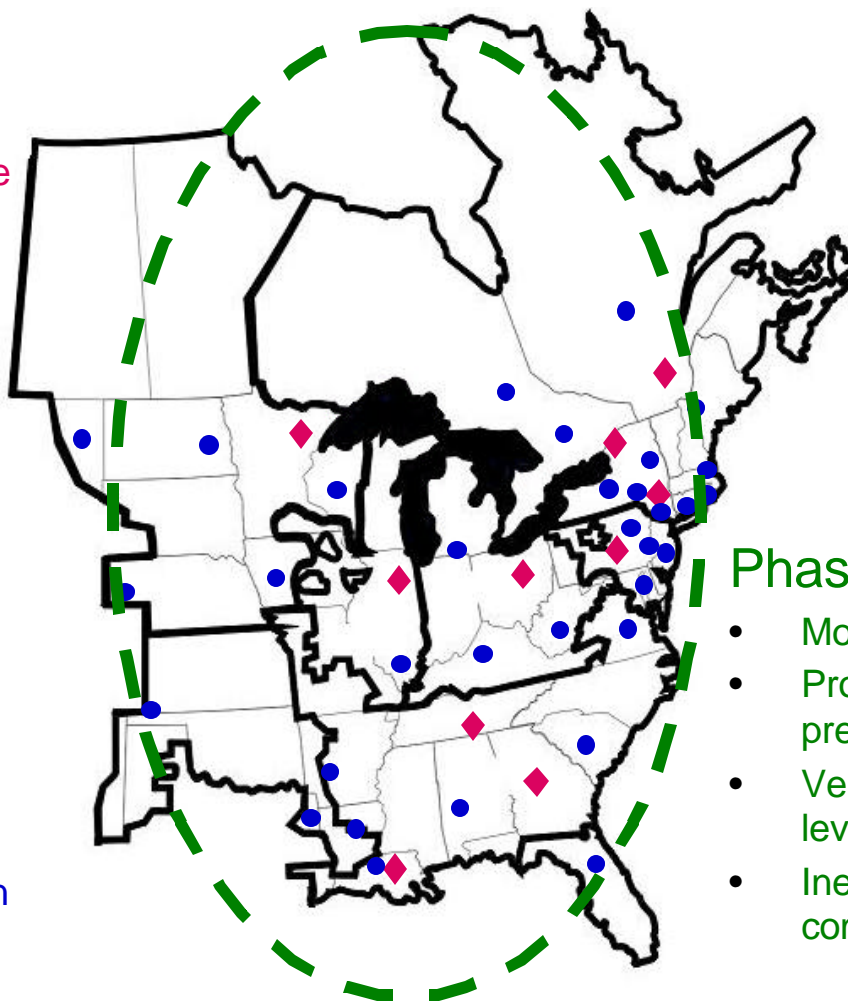
# Proposed Plan

## Phase I (2003-2004)

- 10-12 Instruments, most are already installed but not connected
- Work out communications issues
- Transfer software tools to users
- Establish relationships

## Phase II (2004-2005)

- ~50 Instruments
- Immediate benefits from previous slide realized
- All major corridors covered
- Data available to research community to begin work on projected benefits



## Phase III (2006- )

- More than 350 Instruments
- Projected benefits from previous slide realized
- Vendors participating at all levels
- Inexpensive instruments and communications available



# *Proposed Role of CERTS & DOE*

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## ➤ PHASE I

- CERTS acts as facilitator among stakeholders
- Provide software tools and training for both operations environment (voltage & frequency profiles, security coordinator tools, etc.) and off-line environment (planning, post-disturbance analysis, model validation, etc.)
- Provide a “data concentrator” to integrate data and disseminate to participants

## ➤ PHASE II

- CERTS engages vendors to incorporate software tools into EMS systems and planning/control environments
- Continued assistance to stakeholders to resolve hardware or software issues
- Development of “projected” benefits such as new state estimator

## ➤ PHASE III

- CERTS supports technical issues as they arise



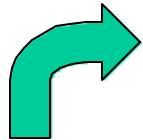


# BPA StreamReader Display

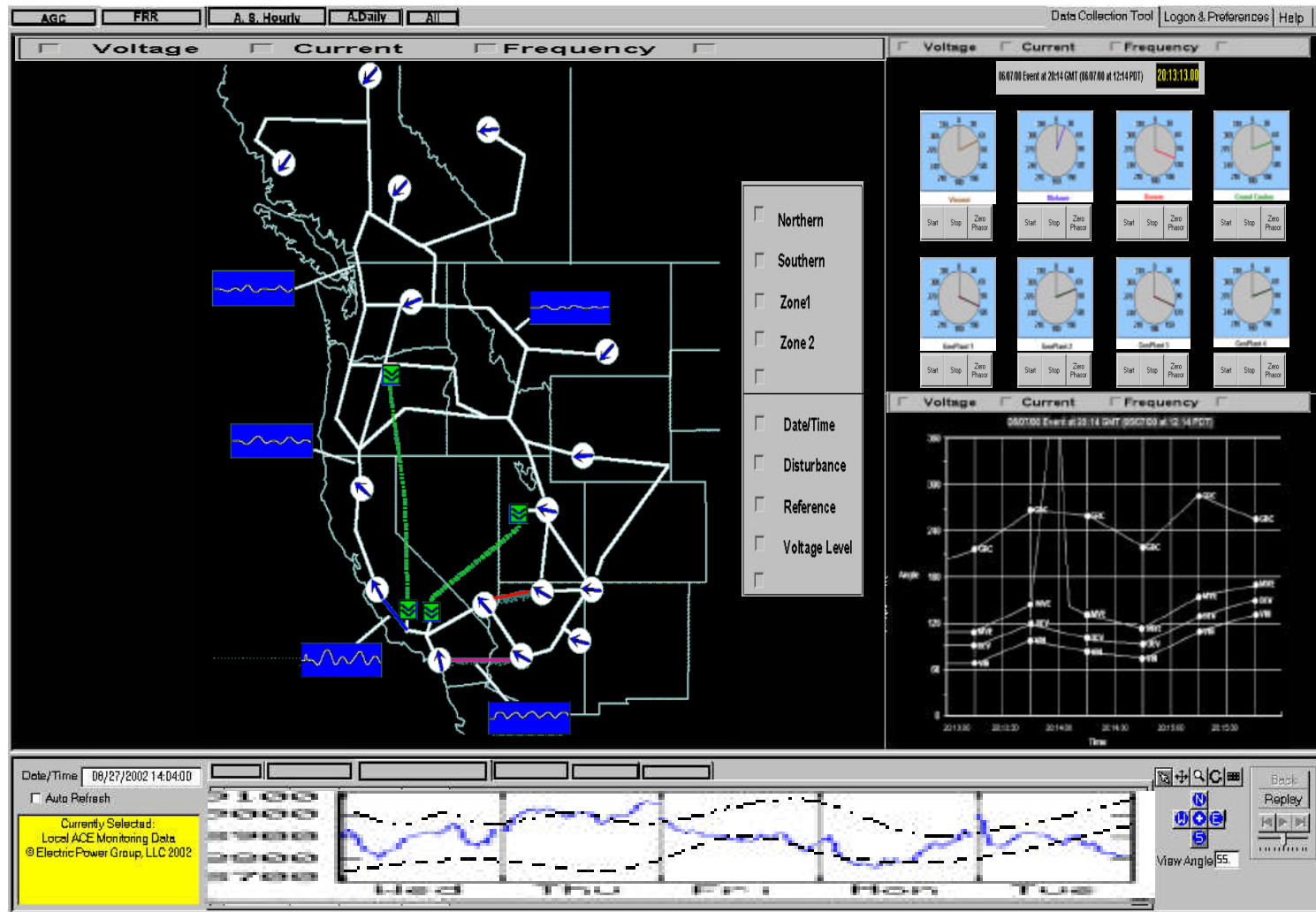
## Oscillations following Alberta separation on August 4, 2000



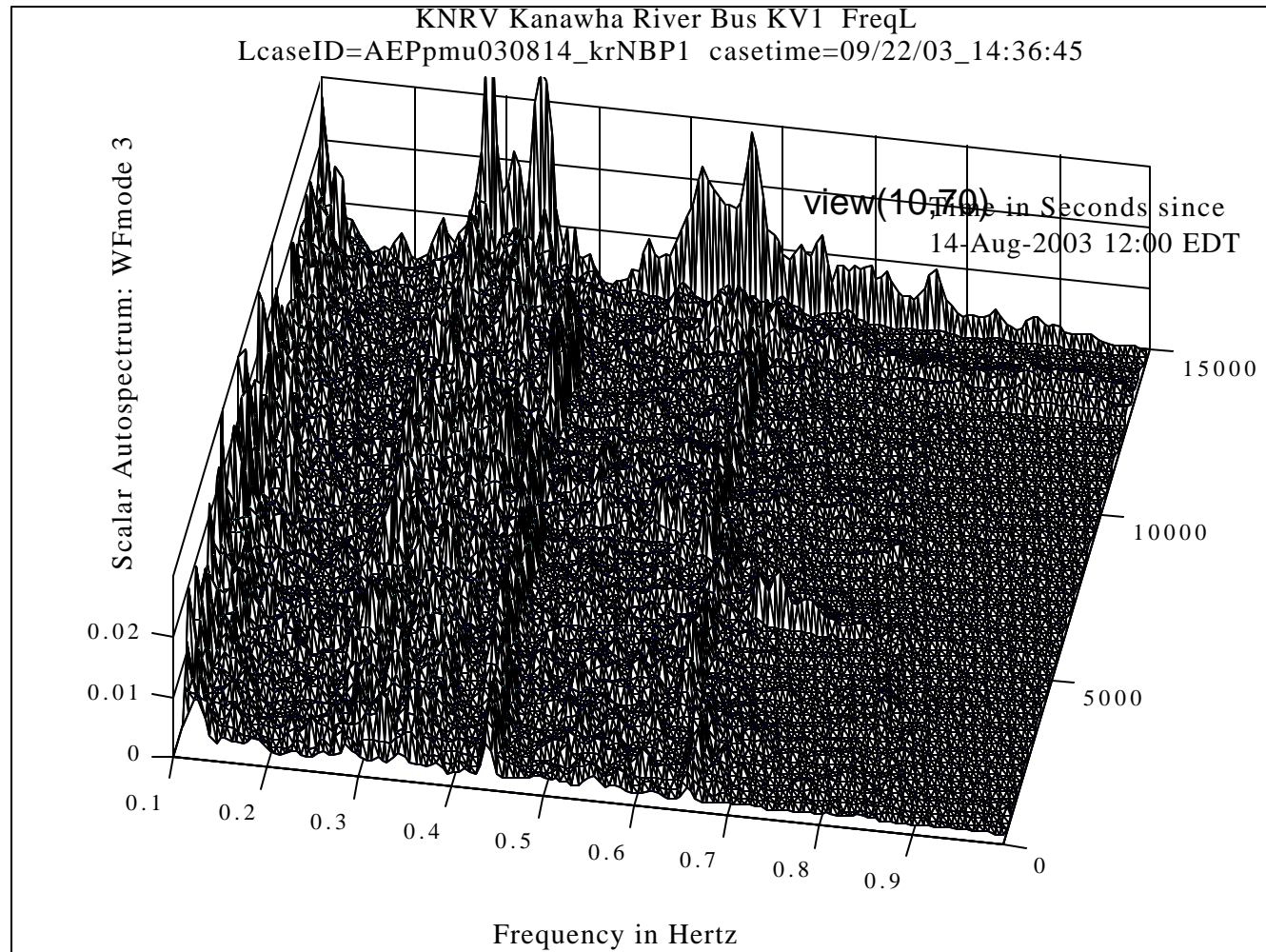
# Synchronized Phasor Technology Applications



Real time  
Monitoring and  
Alarming of  
regional angle  
differences  
against  
predefined  
thresholds



# *AEP Kanawha River bus frequency for Aug14 Blackout 12:00-16:10 EDT*



# *Proposed PDC Locations (Phase 1)*

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- TVA Installation
  - October 2003
- NYISO Installation
  - February 2004
- Both installations coordinated with reliability councils and ISOs to serve broad regional needs



# *Status Update*

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- ☐ Meetings with Major System Operators
  - Sept 2002 through May 2003
- ☐ Development of Project Plan
  - April 2003 through June 2003
- ☐ Procure/Program/Deploy 1<sup>st</sup> Phasor Data Concentrator at TVA
  - October 2003
- ☐ Preliminary integration of phasor / PPSM data from several existing EI instruments (WAMs outreach)
- ☐ EIPP Roadmap Meeting in DC - October 29, 2003
- ☐ Form EIPP Working Group - November 2003
- ☐ Procure/Program/Deploy 2<sup>nd</sup> PDC at NYISO - February 2004
- ☐ Discussions underway with AEP and Ameren for PDC linkage



# *EIPP Working Group*

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- *Vision – improve power system reliability through wide-area measurement, monitoring and control*
- **Participating Organizations (as of December 2003)**
  - USDOE (Chair, Phil Overholt)
  - AEP
  - Ameren
  - CERTS
  - Entergy
  - FERC
  - MISO
  - NERC
  - NYISO
  - NYPA
  - PJM
  - Southern Company
  - SPP
- **Task Team Organization**
  - Phase 1 Implementation
  - Real-Time Applications
  - Off-Line Applications
  - Business Management
  - Standards & Performance





# *Next Steps*

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- Accelerate the Working Group activities based upon urgency established by the August 2004 outage and subsequent investigation
- Prioritize FY04 funding to ensure that initial network is established as quickly as possible.
- Work with industry to determine options for rapid implementation and expansion pending outcomes of Phase 1 and the upcoming Outage Report recommendations.

